

Real-life graphs

Exam questions

Foundation and Higher tiers

Please write clearly in block capitals.

Name

Class **Teacher**

Time allowed: 100 minutes

Materials

For this booklet you need a black pen, a pencil, a ruler, a rubber and a calculator for Section B.

Instructions

- Use black ink or black ballpoint pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided.
- **Section A** (questions 1 to 9): you must not use a calculator.
- **Section B** (questions 10 to 21): you may use a calculator.
- Do all rough work in this booklet. Cross through any work you do not want marked.

Information

- The marks for each question are shown in brackets.
- The maximum mark for this booklet is 90.

Advice

- Read each question carefully.
- In all calculations, show clearly how you work out your answer.

For teacher's use

Q	Mark	Q	Mark
1		12	
2		13	
3		14	
4		15	
5		16	
6		17	
7		18	
8		19	
9		20	
10		21	
11			
TOTAL			

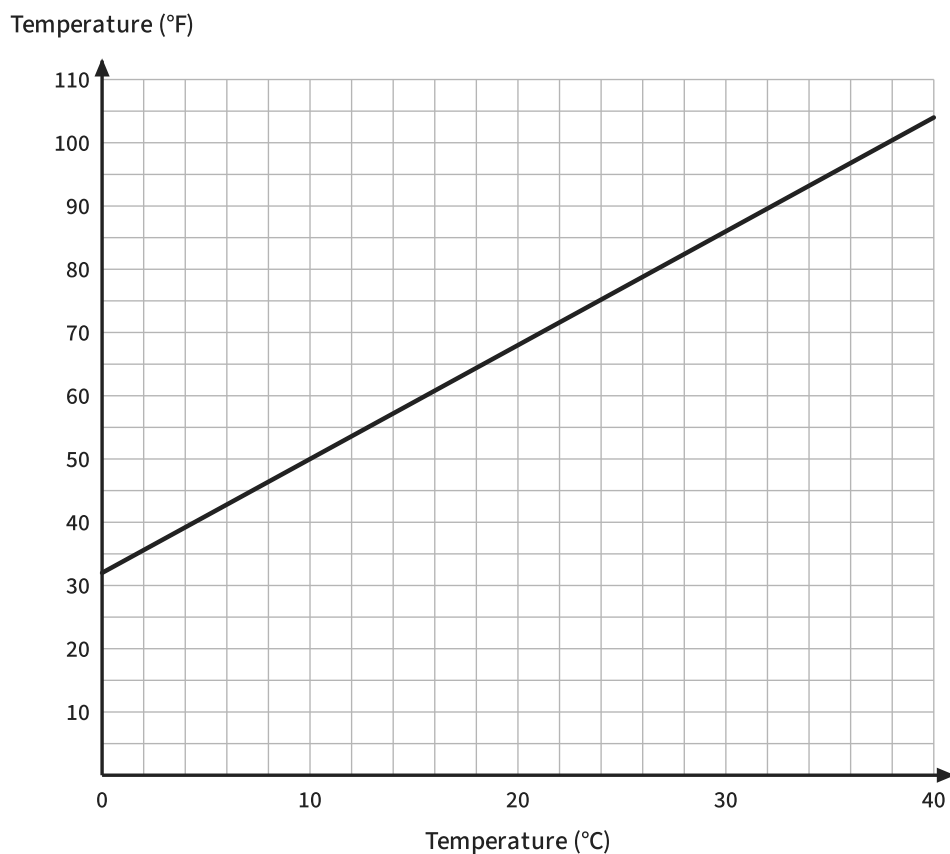
Section A



You must not use a calculator

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the box

- 1** You can use this graph to change between temperatures in degrees Celsius ($^{\circ}\text{C}$) and degrees Fahrenheit ($^{\circ}\text{F}$)



- (a)** Use the graph to change 25°C to $^{\circ}\text{F}$

Answer _____ $^{\circ}\text{F}$
[1 mark]

- (b)** Use the graph to change 50°F to $^{\circ}\text{C}$

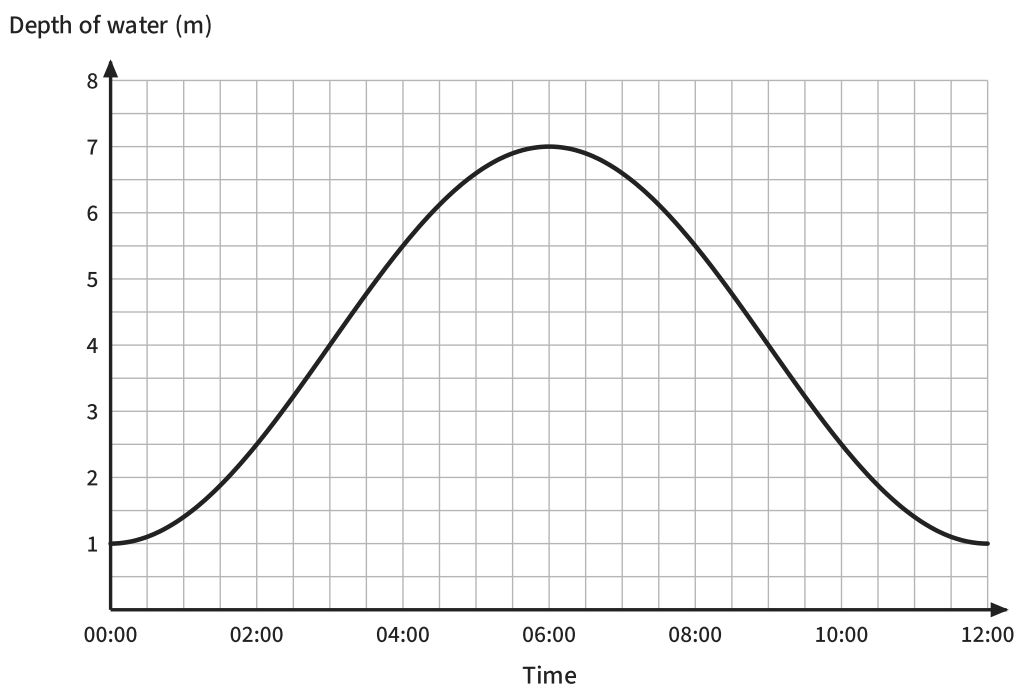
Answer _____ $^{\circ}\text{C}$
[1 mark]

- (c)** One day it was 35°C in Seville and 100°F in Phoenix.
Which city was hotter?
You must show your working.

[2 marks]

- 2 The graph shows the depth of water in a harbour between 00:00 and 12:00 one day.

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- (a) Write down the greatest depth of water.

Answer _____ m

[1 mark]

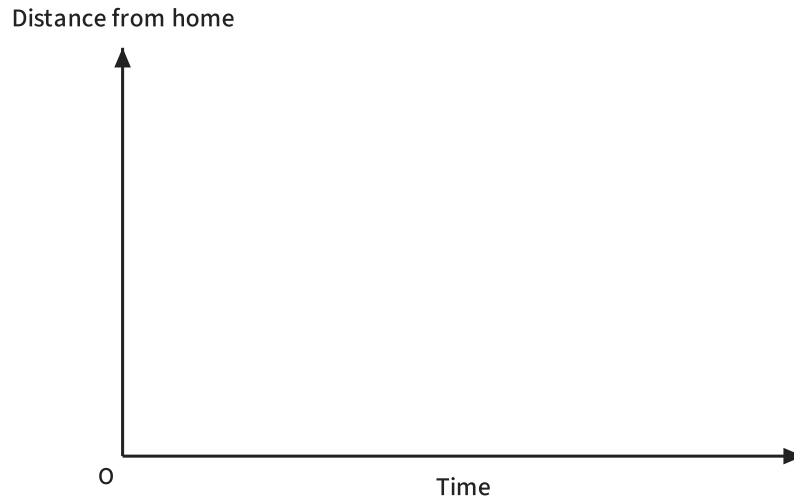
- (b) A boat can only use the harbour when the depth of water is at least 5.5 m
Between which two times can the boat use the harbour?

Answer _____

[2 marks]

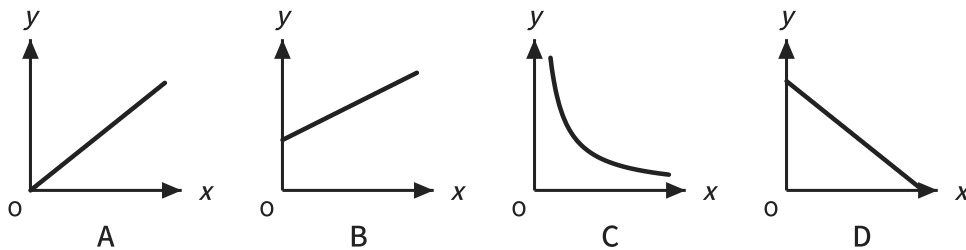
- 3** Kiran walks from his home to a shop at a constant speed.
He stays in the shop for a few minutes.
He then runs home at a faster constant speed.

On the axes, sketch a distance-time graph for Kiran's trip.



[3 marks]

- 4** Here are sketches of four graphs.



- (a) Which graph shows that y is directly proportional to x ?

Answer _____

[1 mark]

- (b) Which graph shows that y is inversely proportional to x ?

Answer _____

[1 mark]

5

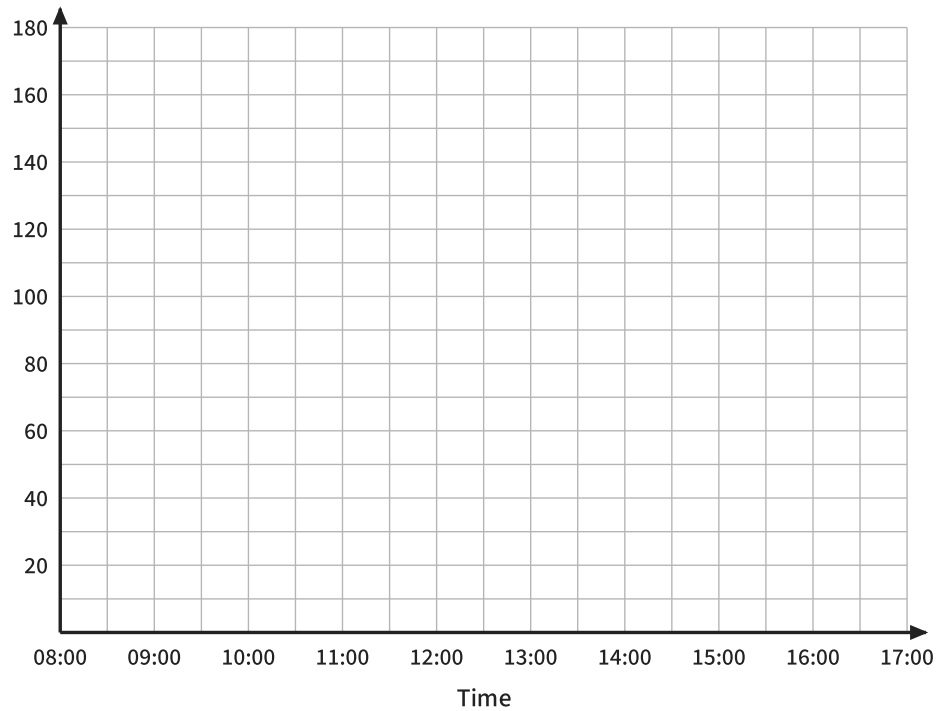
A water butt holds 160 litres when it is full.

At 08:00 the water butt is full. A tap is then opened.

Water flows out at a constant rate of 20 litres every hour until the water butt is empty.

- (a) On the grid, draw a graph to show the volume of water in the water butt from 08:00 until it is empty.

Volume of water (litres)



[2 marks]

- (b) Use your graph to find the time when there are 70 litres of water left.

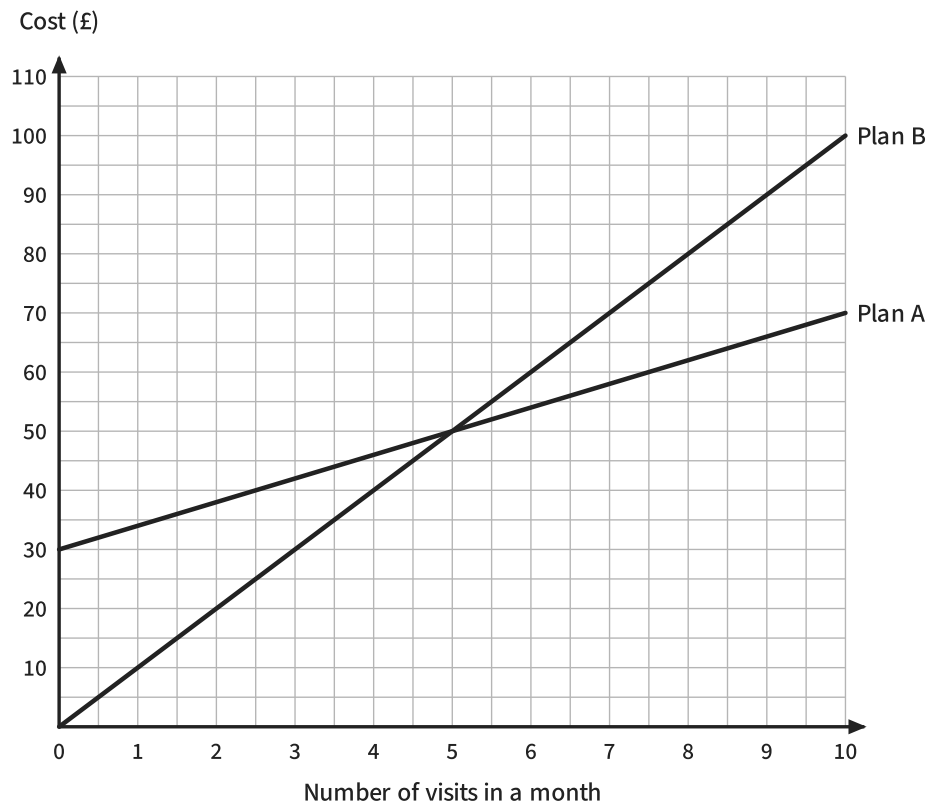
Answer _____

[1 mark]

6

A climbing centre has two payment plans.

The graph shows the monthly cost of each plan for different numbers of visits.



- (a) For how many visits do the two plans cost the same?

Answer _____

[1 mark]

- (b) Zara visits the climbing centre 8 times in a month.
Which plan is cheaper for her, and by how much?

Answer _____

[2 marks]

- (c) What does the gradient of the line for Plan A represent?

[1 mark]

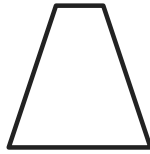
7

Water is poured at a constant rate into each of the containers **A**, **B** and **C**.
The graphs **P**, **Q** and **R** show how the depth of the water changes with time.

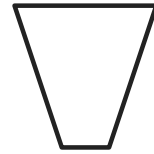
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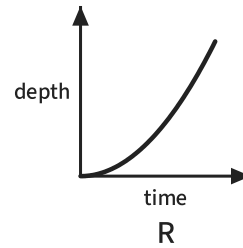
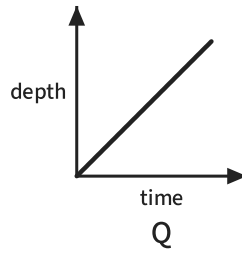
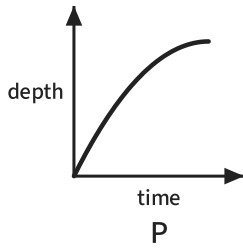
A



B



C



Match each container to its graph.

Container	A	B	C
Graph			

[2 marks]

8

Sam drives 120 km

The time, t hours, the journey takes at an average speed of v km/h is given by $t = \frac{120}{v}$

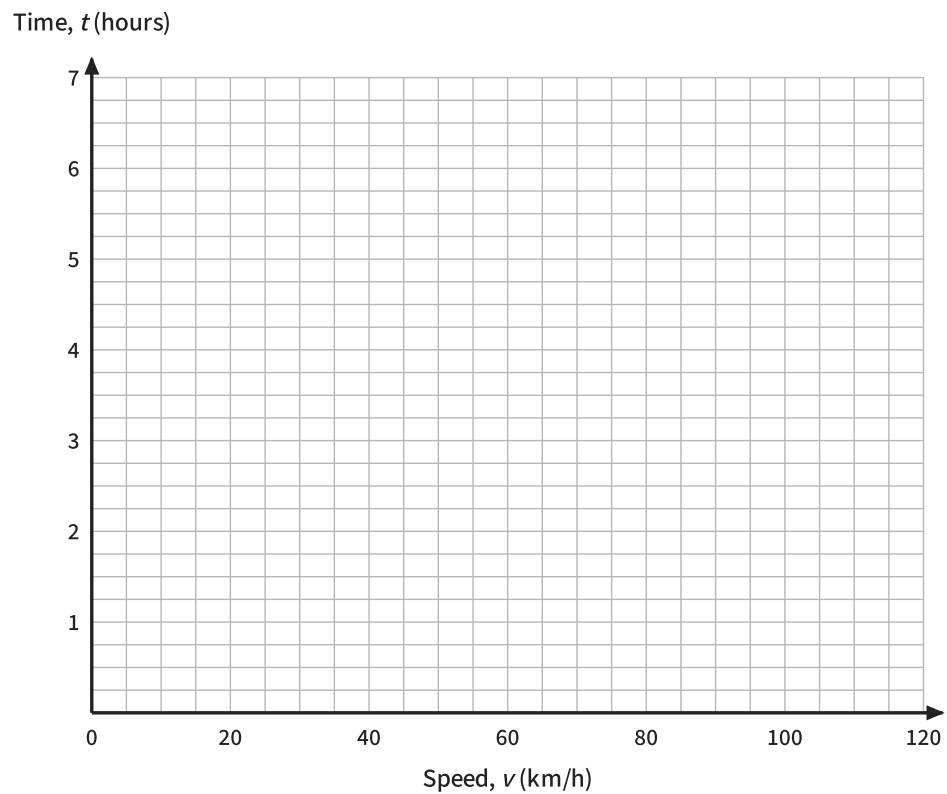
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(a) Complete the table.

Speed, v (km/h)	20	30	40	60	80	120
Time, t (hours)	6		3			1

[2 marks]

(b) On the grid, draw the graph of $t = \frac{120}{v}$ for values of v from 20 to 120



[2 marks]

(c) Use your graph to estimate the average speed Sam needs for the journey to take 2.5 hours.

Answer _____ km/h

[1 mark]

9

A lift starts from rest at the bottom of a tower.

It speeds up at a constant rate until its speed is 4 m/s

It then travels at 4 m/s

It then slows down at a constant rate until it stops at the top.

The lift slows down at twice the rate at which it speeds up.

The whole journey takes 40 seconds and the lift rises 130 m

Work out the acceleration of the lift while it speeds up.

You may sketch a velocity-time graph to help you.

Answer _____ m/s^2

[5 marks]

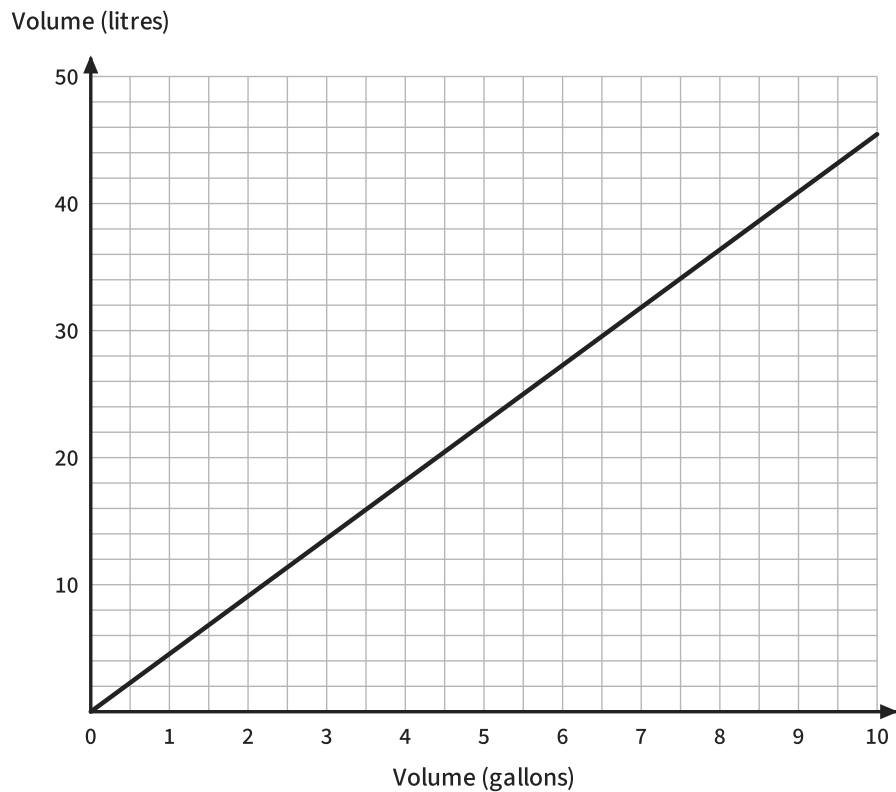
Section B



You may use a calculator

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- 10** You can use this graph to change between volumes in gallons and volumes in litres.



- (a)** Use the graph to change 3 gallons to litres.

Answer _____ litres

[1 mark]

- (b)** Ade's vintage tractor has an empty fuel tank.
The tank holds 7 gallons.
Diesel costs £1.43 per litre.

Use the graph to work out the cost of filling the tank with diesel.

Answer £ _____

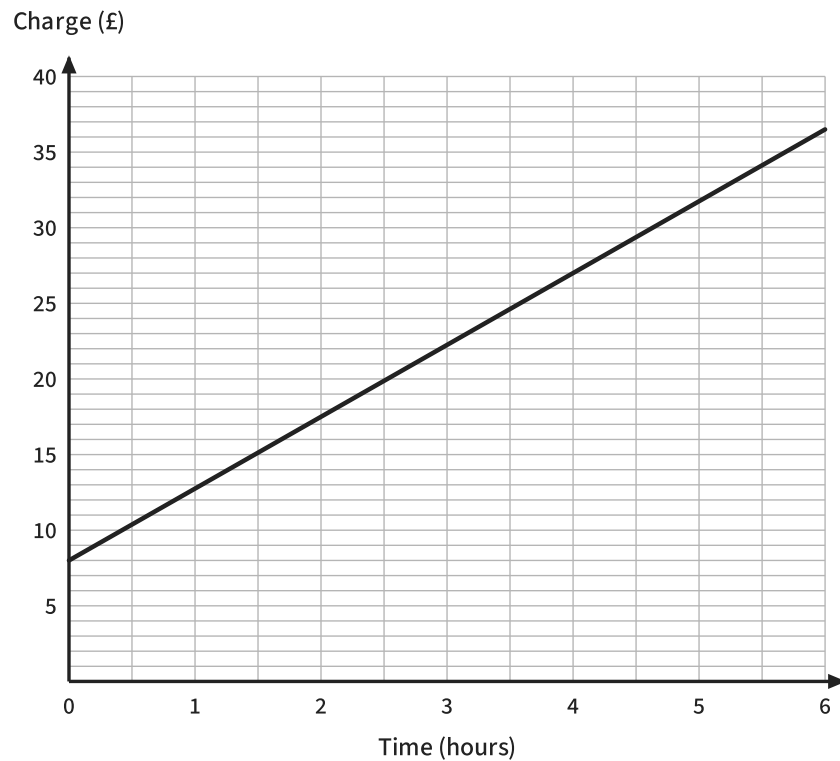
[2 marks]

11

A lake hires out paddle boards.

The graph shows the charge, in pounds, for hiring a paddle board for up to 6 hours.

The charge is a fixed fee plus an extra charge for every hour.



- (a) Use the graph to find the charge for hiring a paddle board for 4 hours.

Answer £ _____

[1 mark]

- (b) Work out the extra charge for every hour.

Answer £ _____

[2 marks]

- (c) Kemi has £50
She hires a paddle board for a whole number of hours.
What is the greatest number of hours she can hire it for?

Answer _____ hours

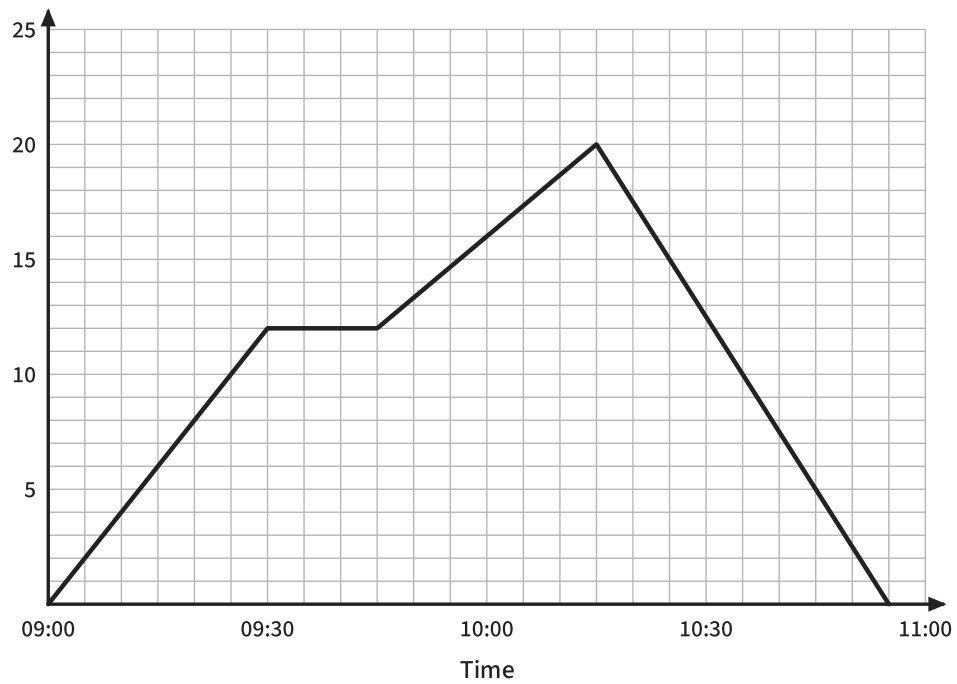
[2 marks]

12

Priya went for a bike ride.

The graph shows her distance from home during the ride.

Distance from home (km)



- (a) For how many minutes did Priya stop?

Answer _____ minutes

[1 mark]

- (b) Work out her speed, in kilometres per hour, for the first 30 minutes of the ride.

Answer _____ km/h

[2 marks]

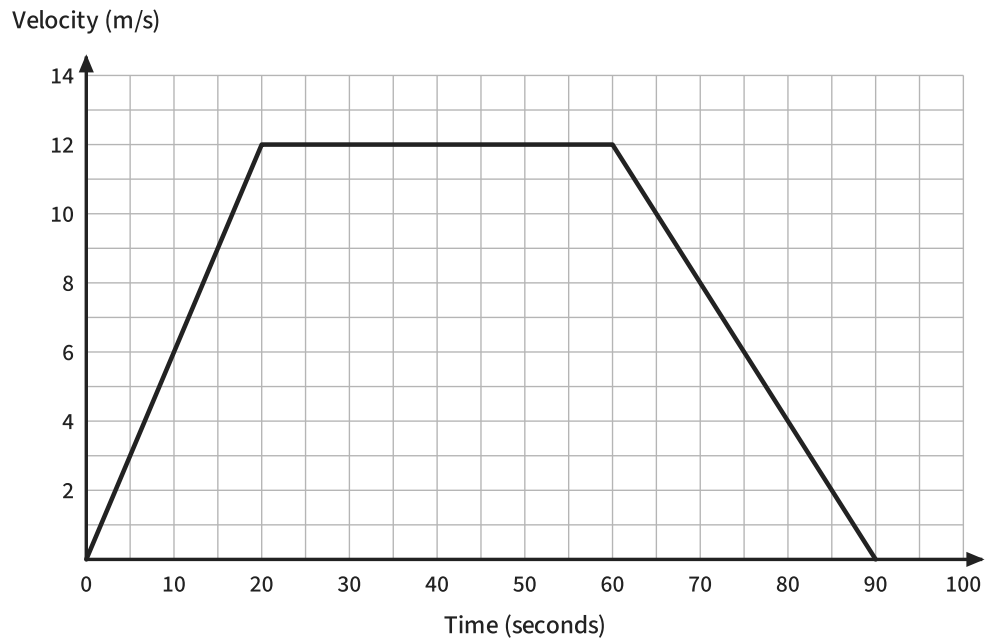
- (c) Was Priya faster in the first 30 minutes or on her way home?
Give a reason for your answer.

[1 mark]

13

The graph shows the velocity of a tram between two stops.

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- (a) Work out the acceleration of the tram in the first 20 seconds.

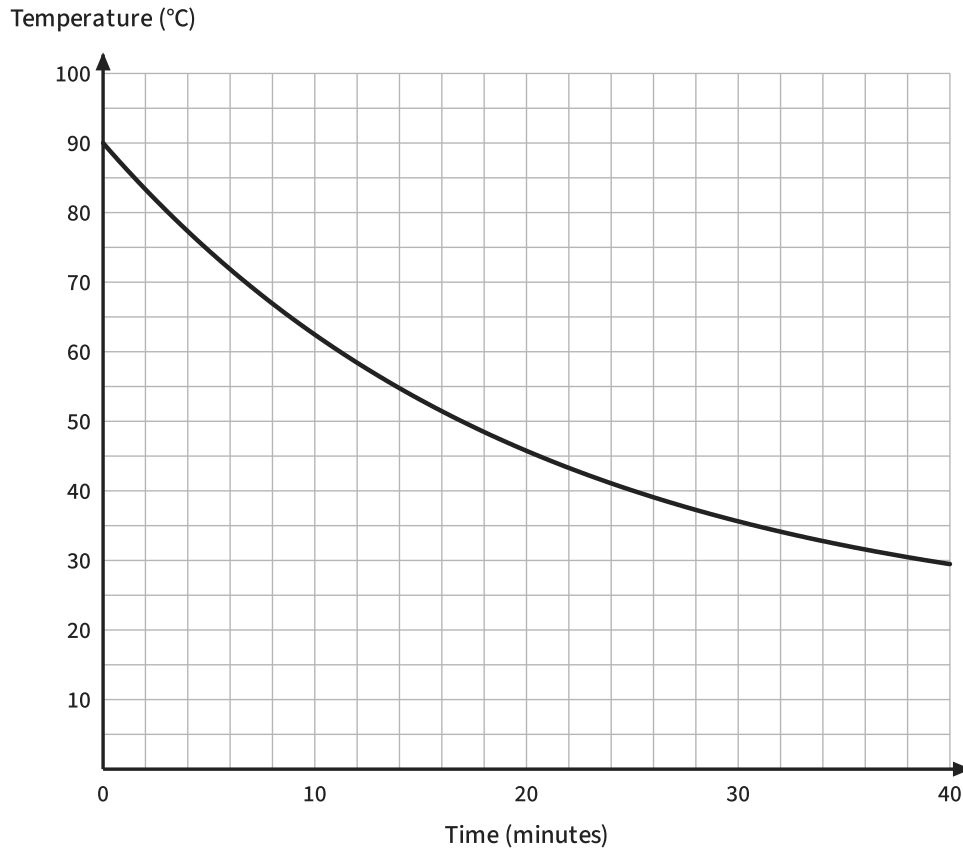
Answer _____ m/s^2
[2 marks]

- (b) Work out the distance between the two stops.

Answer _____ m
[3 marks]

- 14** The graph shows the temperature of a cup of tea as it cools.

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- (a)** Work out the average rate at which the temperature falls in the first 20 minutes.

Answer _____ $^{\circ}\text{C}$ per minute
[2 marks]

- (b)** Estimate the rate at which the temperature is falling at 10 minutes.
You must show your working on the graph.

Answer _____ $^{\circ}\text{C}$ per minute
[3 marks]

- 15** The graph shows the speed of a drone during the first 8 seconds of a flight.

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- (a)** Use 4 strips of equal width to work out an estimate for the distance the drone travels in the first 8 seconds.

Answer _____ m

[3 marks]

- (b)** Is your answer to part (a) an underestimate or an overestimate of the actual distance?
Give a reason for your answer.

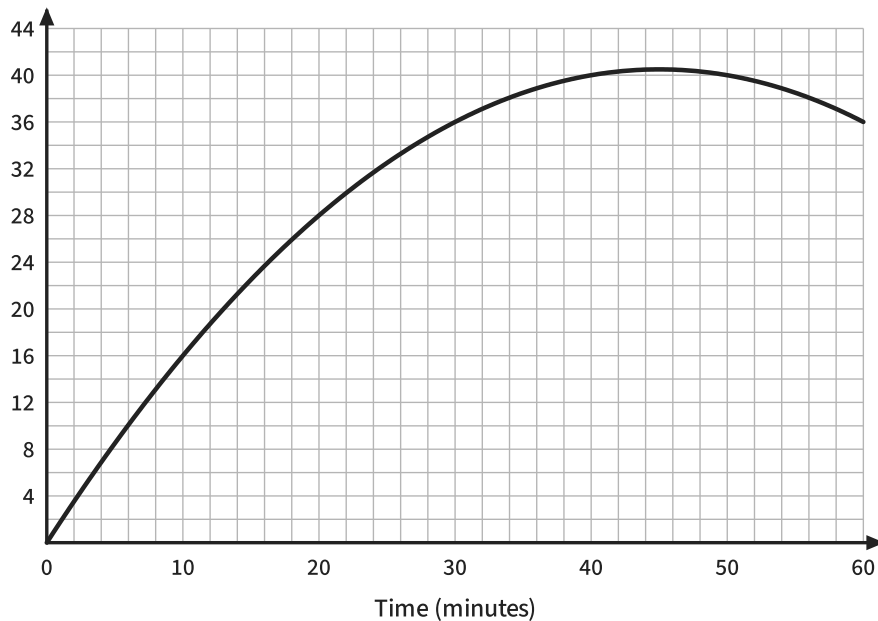
[1 mark]

16

Rainwater from the roof of a school flows into a tank.

The graph shows the rate at which water flows into the tank during the first hour of a storm.

Rate of flow (litres per minute)



- (a) What does the area under the graph represent?

[1 mark]

- (b) Use 3 strips of equal width to work out an estimate for the volume of water that flows into the tank in the first hour.

Answer _____ litres

[3 marks]

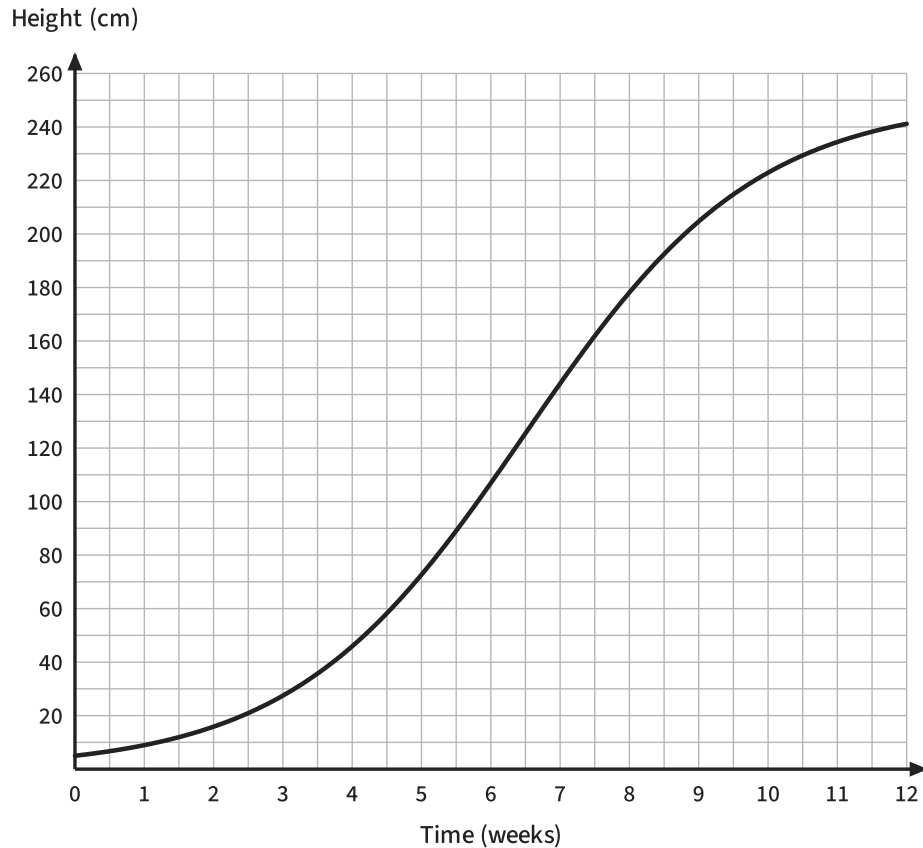
- (c) The tank holds 2000 litres. Before the storm there were 250 litres of water in it. Lena says, “Your estimate shows that the tank will not overflow during the first hour.”

Is Lena right? Give a reason for your answer.

[2 marks]

- 17** The graph shows the height of a sunflower over 12 weeks.

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- (a) Estimate the rate at which the sunflower was growing at 4 weeks.
You must show your working on the graph.

Answer _____ cm per week
[3 marks]

- (b) Estimate the time at which the sunflower was growing fastest.

Answer _____ weeks
[1 mark]

- (c) A straight line is drawn from the point on the curve at 2 weeks to the point on the curve at 10 weeks.
What does the gradient of this line represent?

[1 mark]

18

A train leaves a station.

It speeds up at a constant rate from rest to 81 km/h in 48 seconds.

It then travels at 81 km/h for 135 seconds.

It then slows down at a constant rate and stops at the next station 36 seconds later.

- (a)** Work out the distance between the two stations.
Give your answer in kilometres.

Answer _____ km

[3 marks]

- (b)** How long after leaving the first station is the train halfway between the two stations?

Answer _____ seconds

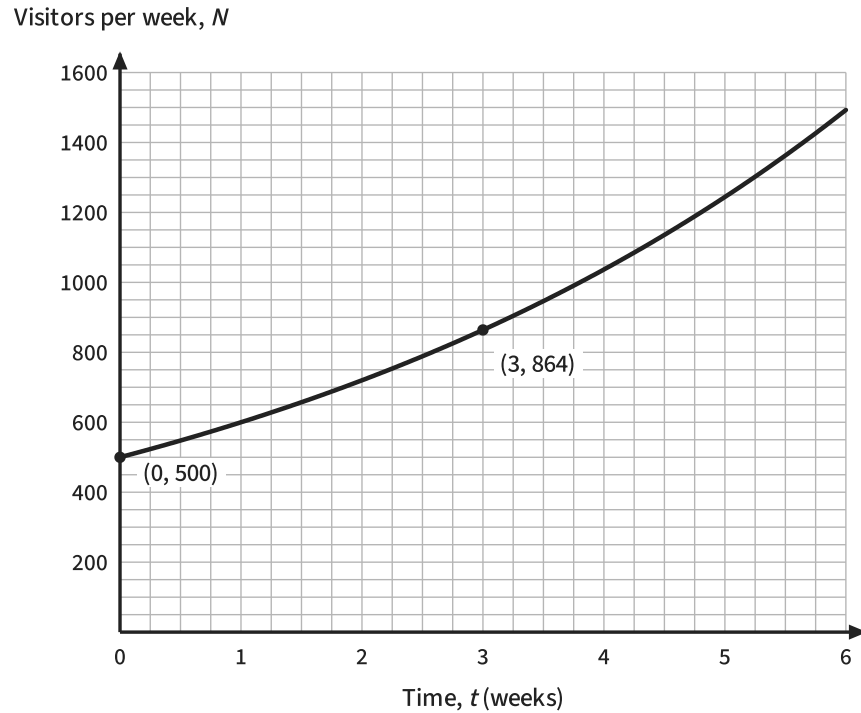
[2 marks]

- 19** The number of visitors per week, N , to a new website t weeks after it opens is modelled by

$$N = a \times b^t$$

where a and b are constants.

The graph of the model passes through the points $(0, 500)$ and $(3, 864)$.



- (a)** Work out the values of a and b .

Answer _____

[3 marks]

- (b)** Work out the smallest whole number value of t for which the model gives more than 2000 visitors per week.
You must show your working.

$t =$ _____

[2 marks]

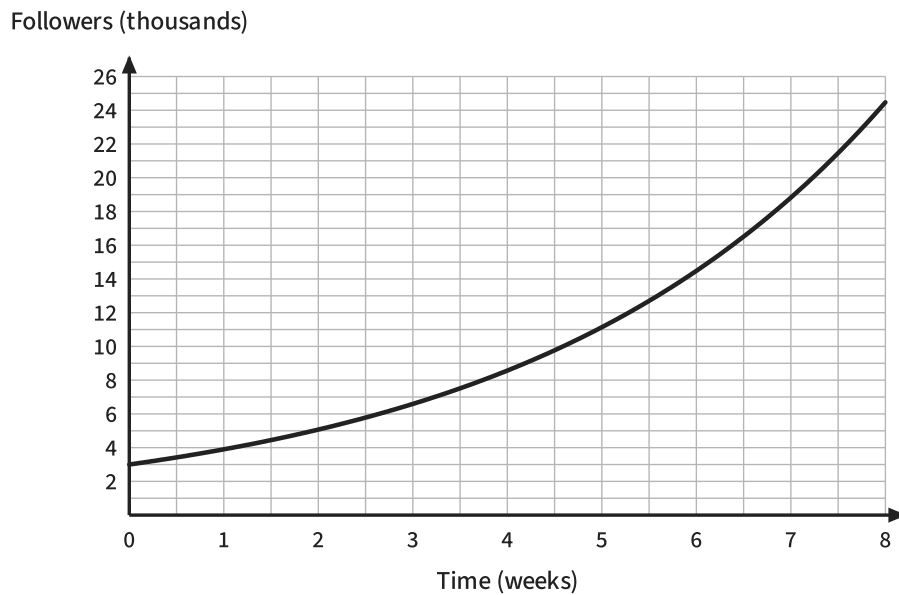
20

A podcast is launched.

The number of followers, N thousand, t weeks after the launch is modelled by

$$N = 3 \times 1.3^t$$

The graph of N against t is drawn for the first 8 weeks.



- (a) Use the formula to work out the average rate of increase in followers over the first 8 weeks.

Give your answer in followers per week to 3 significant figures.

Answer _____ followers per week

[2 marks]

- (b) Estimate a time at which the number of followers was increasing at the rate you found in part (a).

You must show your working on the graph.

Answer _____ weeks

[3 marks]

- (c) Explain why there is only one time in the first 8 weeks at which the number of followers is increasing at this rate.

[1 mark]

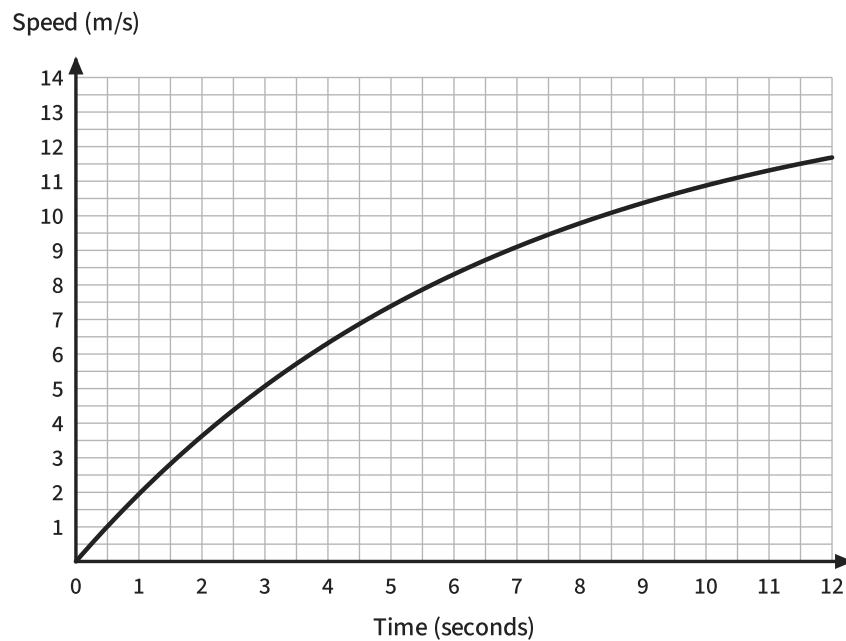
21

A car is waiting at traffic lights.

The lights change and the car starts to move.

At that moment a cyclist passes the car, riding at a constant speed of 8 m/s

The graph shows the speed of the car for the first 12 seconds.



- (a) Use 4 strips of equal width to work out an estimate for the distance the car travels in the first 12 seconds.

Answer _____ m

[3 marks]

- (b) Use your answer to part (a) to estimate how far ahead of the car the cyclist is after 12 seconds.

Answer _____ m

[1 mark]

- (c) Estimate the time at which the cyclist is furthest ahead of the car.
Give a reason for your answer.

Answer _____ seconds

[2 marks]

END OF QUESTIONS